# EXHIBIT A

REDACTED

| | |
|---|---|
| DISTRICT COURT, ARAPAHOE COUNTY, STATE OF COLORADO<br>7325 S. Potomac St.<br>Centennial, Colorado 80112 | ▲COURT USE ONLY▲ |
| **PEOPLE OF THE STATE OF COLORADO**<br><br>**v.**<br><br>**JAMES EAGAN HOLMES,**<br>**Defendant** | Case No. **12CR1522**<br><br>Division: **201** |

**ORDER REGARDING DEFENDANT'S MOTION TO PRECLUDE EXPERT OPINION TESTIMONY OF BOMB TECHNICIANS AND/OR ANY OTHER EXPLOSIVES EXPERTS, PURSUANT TO CRE 702 AND 403, DUE PROCESS, AND *PEOPLE V. SHRECK*, 22 P.3D 68 (COLO. 2001) (D-109)**

## INTRODUCTION

In Motion D-109, the defendant "objects to the admission of any and all expert opinion testimony" by "bomb technicians or others who may claim to potentially have specialized or technical knowledge and experience regarding bombs, explosives or incendiary devices." Motion at p. 1. The defendant requests an evidentiary hearing "and/or an order precluding" this evidence. *Id.* The prosecution opposes the motion. *See generally* Response. On October 22, 2013, the Court held an evidentiary hearing on some, but not all, of the expert opinions challenged in Motion D-109. For the reasons articulated in this Order, the Court

now finds that all of the proffered expert testimony identified in Motion D-109 is admissible under CRE 702 and the standard articulated by the Colorado Supreme Court in *People v. Shreck*, 22 P.3d 68 (Colo. 2001). Accordingly, the defendant's motion is denied.

**CREDIBILITY DETERMINATIONS**

At the October 22 hearing, the prosecution presented testimony from: David McCollam, Pamela Reynolds, and Andria Mehltretter. The defendant did not present any testimony.

The Court observed each witness's manner, demeanor, and body language while on the stand, and considered each witness's means of knowledge, strength of memory, and opportunity for observation. With respect to each witness, the Court assessed the reasonableness or unreasonableness of the testimony, the consistency or lack of consistency of the testimony, and whether the testimony was contradicted or supported by other evidence. The Court examined whether the witnesses had a motive to lie, as well as whether bias, prejudice, or interest in the case affected their testimony. Finally, the Court took into account all other facts and circumstances shown by the evidence which affected the credibility of any of the witnesses.

The Court found the prosecution's witnesses credible. This credibility determination is reflected in the Analysis section of this Order.

## ANALYSIS

### I. Standard of Review Governing the Admissibility of Expert Testimony in Colorado—CRE 702 and *People v. Shreck*

The admissibility of expert testimony in Colorado is governed by Rule 702 of the Colorado Rules of Evidence and the Colorado Supreme Court's analysis and application of that rule in *People v. Shreck*, 22 P.3d 68 (Colo. 2001). Rule 702 provides:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

CRE 702. To be admissible under Rule 702, expert testimony must be both reliable and relevant. *People v. Ramirez*, 155 P.3d 371, 378 (Colo. 2007).

In determining whether expert testimony is reliable, the Court must consider: (1) whether the scientific principles underlying the witness's testimony are reasonably reliable; and (2) whether the witness is qualified to render an opinion on such matters. *Shreck*, 22 P.3d at 77 (citation omitted). The Court's inquiry "should be broad in nature" and take into consideration "the totality of the circumstances of each specific case." *Id.* (citations omitted). The Court may consider "a wide range of factors" that may be pertinent to the evidence at issue, including: (1) whether the scientific principle or technique has been tested; (2) whether the theory or technique has been peer reviewed and published; (3) whether

there are standards controlling the technique's operation and its known or potential rate of error; (4) whether the technique has been generally accepted by the relevant scientific community; (5) the relationship of the proposed technique to more established methods of scientific analysis; and (6) the non-judicial uses to which the technique is put, if any. *Id.* at 77-79 (citing *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 593-94, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993) and *United States v. Downing*, 753 F.2d 1224, 1238-39 (3rd Cir. 1985)).

The Court is not required to consider any particular set of factors. *Id.* at 78. Rather, it may "consider [any] factors . . . to the extent that it finds them helpful in determining the reliability of the proffered evidence." *Id.*; *see also Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 150, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999) (noting that "[t]he factors identified in *Daubert* may or may not be pertinent in assessing reliability, depending on the nature of the issue, the expert's particular expertise, [] the subject of his testimony," and the particular circumstances of the case) (quotation omitted); *Brooks v. People*, 975 P.2d 1105, 1114 (Colo. 1999) (declining to "give any special significance" to the factors listed in *Daubert*, and directing trial courts to "focus instead on whether the evidence is reasonably reliable information that will assist the trier of fact").

In deciding whether expert testimony is relevant, the Court must consider its usefulness to the jury. *Shreck*, 22 P.3d at 77 (citing *Brooks*, 975 P.2d at 1114).

Testimony is "useful" for purposes of Rule 702 if it will assist the jury to either understand other evidence or determine a fact at issue. *Ramirez*, 155 P.3d at 379 (citation omitted). There must be "a logical relation between the [expert] testimony and [a] factual issue involved in the case." *Id.* (citation omitted).

A number of factors are pertinent to a determination regarding the usefulness of proffered expert testimony. *Id.* Specifically, the Court should consider: (1) the elements of the particular offense; (2) the nature and extent of other evidence in the case; (3) the witness's expertise; (4) "the sufficiency and extent of the foundational evidence" upon which the witness's ultimate opinion is to be based; and (5) the scope and the content of the opinion itself. *Id.*; *Masters v. People*, 58 P.3d 979, 990 (Colo. 2002) (citing *Lanari v. People*, 827 P.2d 495, 504 (Colo. 1992)).

Even if an expert's testimony is reliable and relevant, before admitting it, the Court must apply CRE 403. *Ramirez*, 155 P.3d at 379. The Court must ensure that the probative value of the evidence is not "substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence." *Id.* (quoting CRE 403). Expert testimony that "has an undue tendency to suggest a decision on an improper basis" should be excluded. *Id.* (citation omitted).

## II. Request for an Evidentiary Hearing

Before addressing the admissibility of the prosecution's proposed expert testimony, the Court first examines the defendant's request for a hearing, which the Court granted in part and denied in part. The Court granted a *Shreck* evidentiary hearing with respect to three of the seven prosecution witnesses endorsed as explosives experts. *See* Order C-51; Order D-174. The defendant argues that an evidentiary hearing is required on all of the prosecution's proposed expert evidence because he clearly identifies the type of expert testimony he wishes to challenge and explicitly requests a hearing under *Shreck*. Reply at p. 1. This contention reflects a fundamental misunderstanding of *Shreck* and its progeny.

*Shreck* requires the Court to make "specific findings on the record" regarding the reliability and relevance of proposed expert testimony. *Shreck*, 22 P.3d at 78 (citations omitted). "The [Court] must also issue specific findings as to its consideration under CRE 403 as to whether the probative value of the evidence is substantially outweighed by its prejudicial effect." *Id.* (citations omitted). While the Court may hold an evidentiary hearing if appropriate, it is not required to do so, "provided it has before it sufficient information to make specific findings . . . about the reliability of the scientific principles involved, the expert's qualification to testify to such matters, the helpfulness to the jury, and potential prejudice." *People v. Rector*, 248 P.3d 1196, 1201 (Colo. 2011) (citations

omitted); *see also People v. Whitman*, 205 P.3d 371, 383 (Colo. App. 2007) ("*Shreck* does not require trial courts to hold hearings to inquire into the reliability of evidence;" what *Shreck* requires is that the trial court "receive sufficient information to make specific findings about the reliability of the scientific principles involved and the expert's qualification to testify to such matters") (citations omitted).

The decision whether to hold an evidentiary hearing is committed to the sound discretion of the Court. *Rector*, 248 P.3d at 1201. "This discretion comports with the [Court's] need to avoid unnecessary 'reliability' proceedings in ordinary cases where the reliability of an expert's methods is properly taken for granted, and to require appropriate proceedings in the less usual or more complex cases where cause for questioning the expert's reliability arises." *Id.* (quoting *Kumho Tire, Co.*, 526 U.S. at 152, 119 S.Ct. 1167).

Similarly, in its discretion, the Court must assess whether a party's challenge to expert testimony warrants analysis under *Shreck*. *Id.* The Court is not required to engage in such analysis if the objecting party fails to sufficiently identify the testimony or witness being challenged or challenges testimony that the expert does not intend to offer. *Id.* "Thus, not every motion will necessitate a *Shreck* analysis." *Id.* Moreover, the Court is not "expected to intuit the challenge brought

by the parties," but need only consider the specific issues set forth in a party's motion when deciding whether to conduct a *Shreck* inquiry. *Id.*

Motion D-109 names a single witness—Special Agent Garrett Gumbinner—even though the prosecution endorsed seven explosives experts. Motion at p. 3. Further, the defendant does not specify what aspects of the proposed expert testimony he finds objectionable. The defendant does not, for example, raise any specific challenges regarding the reliability of any of the scientific techniques or principles relied upon by any expert, the qualifications of any expert, the relevance of any expert's anticipated testimony, or the potential prejudice he may suffer as a result of any expert's opinions. Instead, he simply objects to "any and all expert opinion testimony" by prosecution witnesses who are purported to have "specialized or technical knowledge and experience regarding bombs, explosives or incendiary devices." *Id.* at p. 1.

The defendant's general objection is insufficient to warrant a *Shreck* analysis, much less an evidentiary hearing. Nevertheless, in an abundance of caution and to avoid delays during the trial, the Court granted the defendant's request for an evidentiary hearing on the proffered testimony of witnesses McCollam, Reynolds, and Mehltretter. *See* Order C-51; Order D-174. With respect to the prosecution's four remaining witnesses, the Court concluded that it

had sufficient information before it to make the specific findings required by *Shreck*.[1]

Based on the evidence in the record, including the testimony presented at the hearing, the Court makes the following findings regarding the reliability and relevance of the prosecution's proffered testimony, as well as its admissibility under CRE 403. Because the Court concludes that the testimony is admissible under CRE 702 and *Shreck*, the motion fails.

## III. Request to Preclude Testimony

### A. Reliability

#### 1. Underlying Scientific Principles and Techniques

First, the Court considers whether the scientific principles and techniques underlying the proffered testimony are reasonably reliable. The prosecution's experts relied on a number of scientific techniques to analyze the various items and materials recovered from the defendant's apartment: (1) flame susceptibility testing; (2) visual, micrsocopal, and stereomicroscopal inspection; (3) gas chromatography/mass spectrometry ("GC/MS"); (4) passive absorption/elution technique utilizing GC/MS; (5) pyrolysis GC/MS; (6) gas chromatography with flame ionization detection; (7) infrared spectroscopy; (8) fourier transform infrared

[1] The prosecution objected to the October 22 hearing, arguing that the defendant's motion did not "actually lodge any challenges to the underlying reliability of [the] expert witnesses' testimony on explosives." Response at p. 2. Significantly, despite being on notice that the prosecution was contesting the sufficiency of his request for a hearing, the defendant's reply was as vague as the motion. *See generally* Reply.

spectroscopy; (9) raman spectroscopy; (10) scanning electron mircroscopy with energy dispersive x-ray spectroscopy; and (11) x-ray diffraction. The Court addresses the reliability of each technique in turn.

**a) Flame Susceptibility Testing**

Flame susceptibility testing, as the name suggests, consists of exposing a material to a flame to determine whether the material reacts in a flammable manner. 10/22/13 Tr. at pp. 133-34. The Court agrees with the prosecution that the reliability of this technique is beyond dispute and warrants no further discussion.

**b) Visual, Microscopic, and Stereomicroscopal Observation or Inspection**

Visual observation and microscopic inspection entail exactly what their names imply and do not warrant further discussion. Stereomicroscopal observation involves examining a sample with a stereomicroscope, which is a microscope that has a set of optics for each eye so that the object being examined appears in three dimensions. *Stereomicroscope*, *Merriam-Webster*, http://www.merriam-webster.com/dictionary/stereomicroscope (last visited March 6, 2014). As with flame susceptibility, the Court finds that the reliability of this technique is beyond dispute and warrants no further analysis.

### c) Gas Chromatography/Mass Spectrometry

Gas chromatography/mass spectrometry ("GC/MS") is a technique that allows chemists to separate the components of a mixture to identify the individual chemicals in them based on their mass spectrum. *United States v. Law*, 528 F.3d 888, 913 (D.C. Cir. 2008); *United States v. Aman*, 748 F. Supp. 2d 531, 542 (E.D. Va. 2010). GC/MS consists of two apparatuses: a gas chromatograph and a mass spectrometer. 10/22/13 Tr. at pp. 143-44.

"[A] gas chromatograph . . . is essentially an extremely sensitive filtering machine [that] is instrumental in breaking down a gas sample or a liquid mixture into its molecular subcomponents." *State v. Lucero*, 85 P.3d 1059, 1060 n.1 (Ariz. Ct. App. 2004) (quoting Peter Joseph Bober, *The "Chemical Signature" of the Fourth Amendment: Gas Chromatography/Mass Spectrometry and the War on Drugs*, 8 Seton Hall Const. L.J. 75, 79-80 (1997)). In order to determine the molecular compounds in a particular liquid, the sample is mixed with a liquid solvent and then heated until the mixture forms a gas. *Id.* The gas is then forced through a glass column that is filled with a special filtration material. *Id.* "Each molecular compound in the sample will elute through a given column and temperature at a specific rate." *Id.* The quantity and concentration of each molecular compound is measured and recorded by a detector at the outgoing end of the column. *Id.* A mass spectrometer may also be used to further break down a

sample by "bombard[ing] the sample with high-energy electrons to generate extensive fragmentation ions." *Id.* By further breaking down the sample, the equipment can more accurately determine which compounds are present. *Id.*[2]

GC/MS has been found to be a reliable scientific technique that is "widely used and generally accepted in the fields of analytical and forensic chemistry." *United States v. Vitek Supply Corp.*, 144 F.3d 476, 485 (7th Cir. 1998); *see also Law*, 528 F.3d at 913 (holding that an expert's testimony that GC/MS is a technique that has been "widely used, and [is] accepted in the relevant scientific community" was sufficient to satisfy *Daubert*); *Aman*, 748 F. Supp. 2d at 542 ("[GC/MS] has been widely recognized as sufficiently reliable to pass muster under *Daubert*") (citations omitted); *State v. Price*, 731 S.W.2d 287, 291 (Mo. Ct. App. 1987) ("The reported decisions and authorities confirm that [GC/MS] is an extremely reliable specific test for the measurement, separation and identification of particular organic compounds") (citations omitted); 3 Wharton's Criminal Evidence § 13:54 (15th ed.) ("GC testing is the most widely used of all testing technologies available in the forensic laboratory. It is also the most versatile and may be used with a variety of detectors . . . such as the flame ionization detector

[2] Mehltretter, an FBI forensic examiner, described this process similarly at the hearing. She explained that after a sample is heated into a gas, it is introduced into a thin glass column with a coating on the inside of it. 10/22/13 Tr. at pp. 32-33. Different components inside the sample will "like" the coating more than others and, as a result, will take more time to elute through the column. *Id.* at p. 33. The mass spectrometer then measures the mass and charges of the different components as they elute through the column. *Id.*

(FID) . . . and mass spectrometry (MS)") (quoting Faigman, et al., Modern Scientific Evidence: The Law and Science of Expert Testimony § 33-2.7.3). Consistent with these authorities, McCollam, a forensic examiner with the FBI, testified that GC/MS has been in use since the 1940s, is currently used in the pharmaceutical, automotive, and medical industries, and is generally accepted as reliable in the scientific community. 10/22/13 Tr. at pp. 145-47.

The Court finds that GC/MS is a reliable scientific technique for identifying individual components of chemical compounds. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

**d) Pyrolysis Gas Chromatography/Mass Spectrometry**

Pyrolysis GC/MS is a process that combines three techniques: pyrolysis, gas chromotagraphy, and mass spectrometry. *Id.* at pp. 32-33. In the pyrolysis portion, the sample is placed into an apparatus called a "pyrolysis chamber" where it is heated to a gaseous phase. *Id.* at p. 35. This allows the sample to be broken into smaller components so that it can be more reliably tested. *Id.* at pp. 32, 34. Once this step is completed, the sample is introduced into the GC/MS and analyzed as described above.

The evidence at the hearing established that pyrolysis-GC/MS is generally accepted as reliable in the scientific community and has been subjected to peer

review. *Id.* at pp. 42-43. The evidence also demonstrated that pyrolysis-GC/MS has "been around for decades" and is used for many non-judicial purposes in academic laboratories and in the pharmaceutical and environmental industries. *Id.* at pp. 34, 46.

The Court finds that pyrolysis-GC/MS is a reliable scientific technique. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

**e) Gas Chromatography with Flame Ionization Detection**

As its name suggests, gas chromatography with flame ionization detection ("GC/FID") combines two processes: gas chromatography and flame ionization detection ("FID"). FID uses a flame made from oxygen and hydrogen to burn the sample as it elutes through the column of the gas chromatography apparatus. *Id.* at p. 140. By burning the sample, the FID generates ions, which are then sent to a detector and converted into an electrical signal. *Id.* Examiners use the data generated to place the sample into a category of substances based on its retention time. *Id.* at p. 141.

GC/FID has been "widely used" in pharmaceuticals, research, and chemical analysis. *Id.* at p. 142. It has been subjected to peer review and publication. *Id.* As such, it is not a new or novel procedure. *Id.* While there are no known error

rates for GC/FID, it is generally accepted as reliable in the scientific community. *Id.*

The Court finds that GC/FID is a reasonably reliable scientific technique. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

**f) Passive Absorption/Elution Utilizing GC/MS**

Passive absorption/extraction utilizing GC/MS is another variation of GC/MS. Most laboratories utilize passive absorption/elution to analyze the compounds in fire debris. Forensic Laboratory Handbook Procedures and Practice, 136 (Ashraf Mozayani & Carla Noziglia eds., 2d ed. 2011). To perform this test, examiners put a sample inside a container with an absorbent material sensitized to organic compounds. *Id.* The container is then heated until any ignitable liquids are volatized and absorbed by the absorbent material. *Id.* The absorbent material is then rinsed with a solvent to extract the absorbed ignitable liquids and analyzed using the GC/MS method described above. *Id.*

The prosecution did not present any testimony at the October 22 hearing regarding this particular form of GC/MS. However, the Court has already found that GC/MS is reliable. The Court concludes that, like other variations of GC/MS, passive absorption/extraction utilizing GC/MS is a reliable scientific technique.

On the record before it, the Court has no basis to rule otherwise. Nor has the defendant advanced a specific challenge to this technique. Of course, the prosecution will have the burden of establishing the reliability of this technique at trial. If the prosecution fails to do so, the defendant may renew his objection.

**g) Infrared Spectroscopy**

Infrared Spectroscopy is a scientific technique that is used to identify an unknown sample based on its unique chemical spectra. *Law*, 528 F.3d at 913. Infrared spectroscopy enables an analyst to obtain "information about the molecular structure of a sample . . . by noting the type and amount of infrared radiation absorbed by the sample." David Polin, *Proof of Identification of Substance by Instrumental Analysis*, 54 Am. Jur. Proof of Facts 3d 381, § 11 (1999). Different substances have characteristic patterns of absorption of particular wavelengths of infrared energy. *Id.* To measure the amount of infrared radiation absorbed by an unknown sample, a beam of infrared radiation is passed through a transparent cell containing the unknown sample. *Id.* "If the infrared transmission at a given wavelength is of the same intensity as the output of the radiation source, then that wavelength of radiation was not absorbed in its passage through the sample material." *Id.* Conversely, if the infrared transmission at a given wavelength has been reduced, then the examiner knows that "energy from the given wavelength of infrared [radiation] has been transferred to the sample

material." *Id.* An apparatus measures the percentage of transmittance of infrared radiation for each wavelength, which is then compared to the absorption spectra of known chemical structures to identify the sample. *Id.*[3]

At least one court has found infrared spectroscopy to be a widely used and generally accepted technique in the scientific community. *Law*, 528 F.3d at 913 (holding the trial court could rely on an expert's testimony—that infrared spectroscopy has been "established for many years, [is] widely used, and [is] accepted in the relevant scientific community"—to conclude that the technique is reliable under *Daubert*); *see also People v. Roraback*, 666 N.Y.S.2d 397, 400 (N.Y. Sup. Ct. 1997), *aff'd*, *People v. Roraback*, 668 N.Y.S.2d 781, 781-82 (N.Y. App. Div. 1998) (finding that a similar technique, fourier transform infrared spectrophotometer, is generally accepted as reliable within the relevant scientific community). Consistent with the ruling in *Law*, Reynolds, a chemist and forensic examiner with the FBI, testified that infrared spectroscopy has been subjected to peer review and publication, is widely accepted as reliable in the scientific community, and is not a new or novel technique. 10/22/13 Tr. at pp. 90-91. Indeed, she testified that infrared spectroscopy is one of the "main techniques"

[3] Infrared spectroscopy was similarly described at the hearing as a technique that "uses light to evaluate a sample, [and] to give information related to the structure of that sample." 10/22/13 Tr. at p. 89. The sample is placed on top of a diamond cell as light is directed up through that cell. *Id.* at p. 91. The apparatus then measures how the compounds in the sample "react to that light"—namely, whether they absorb or reflect that light. *Id.* at pp. 89-90.

used at the FBI laboratory to analyze unknown substances, and particularly to identify controlled substances. *Id.* at p. 91.

The Court finds that infrared spectroscopy is scientifically reliable. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

**h) Fourier Transform Infrared Spectroscopy**

Fourier transform infrared spectroscopy ("FTIR") is a variation of infrared spectroscopy. FTIR works by splitting a single beam of infrared light into two beams, passing one beam through the sample, and putting the two beams back together. *Roraback*, 666 N.Y.S.2d at 399. The reunited beam of light will have different characteristics than it did before it passed through the sample because of the absorption of various wavelengths of light by the sample. *Id.* A complex mathematical equation, known as a Fourier Transform, is thereafter applied to the wavelengths to segregate the intensity of each independent wavelength. *Id.* A computer within the FTIR apparatus then produces a graphical representation of those wavelengths which can be compared against graphs of known substances to identify the sample. *Id.*

Other courts have recognized that FTIR is "widely used and generally accepted in the fields of analytical and forensic chemistry." *Vitek Supply*, 144 F.3d

at 485; *see also Roraback*, 666 N.Y.S.2d at 400 (holding the FTIR device is "accepted as reliable within the scientific community generally and also within the forensic scientific community"); *Glaxo Inc. v. Novopharm Ltd.*, 931 F. Supp. 1280, 1287 (E.D.N.C. 1996) ("FTIR is not only much faster than conventional spectroscopy, it is also far more accurate"); *Astra Aktiebolag v. Andrx Pharm., Inc.*, 222 F. Supp. 2d 423, 501 (S.D.N.Y. 2002) (finding a similar technique, attenuated total reflectance fourier transform infrared spectroscopy, or "ATR–FTIR," to be an accurate and reliable analytical technique for analyzing the chemical composition of a sample). Consistent with these authorities, Mehltretter, an FBI forensic examiner, testified that FTIR (including the techniques used to interpret the graphs generated by the FTIR apparatus) is deemed generally reliable in the field of forensic chemistry and material analysis. 10/22/13 Tr. at pp. 66-67. FTIR is not new or novel; it has been used in the field of forensic chemistry "for decades." *Id.* at pp. 26-27. It is a "common" technique employed to perform chemical analysis and is used in pharmaceutical, environmental, and academic laboratories. *Id.* at p. 46. Indeed, FTIR is, "by and large, the first technique that [forensic examiners] will use when trying to determine . . . the chemical characteristics of a material." *Id.* at pp. 23-24. FTIR has also been subjected to peer review and publication. *Id.* at pp. 42-43.

The Court finds that FTIR is scientifically reliable. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

**i) Raman Spectroscopy**

Raman spectroscopy is another scientific method used for identifying the chemical composition and structure of compounds. *Warner Chilcott Labs. Ireland Ltd. v. Impax Labs., Inc.*, 2012 WL 1551709, at *9 (D.N.J. 2012). Raman spectroscopy works by passing a laser beam over a solid or liquid sample. 10/22/13 Tr. at p. 135. As the beam focuses on the sample, it causes the sample's molecules to "become[] excited." *Id.* When that occurs, the electrons from that molecule "jump" to a "different energy level." *Id.* As the electrons return from that energy level to their initial level, light is emitted. *Id.* That light, in turn, is captured by the raman spectroscopy apparatus and is recorded as data. *Id.*

The raman spectra that are produced are referred to as "fingerprints" because each molecule produces a unique spectrum. *Impax Labs.*, 2012 WL 1551709, at *9. To determine the chemical composition of the unknown sample, examiners first obtain or develop a list of materials that they "know or suspect are in the sample." *Id.* They subsequently obtain fingerprints or "reference spectra" for each individual material. *Id.* at *10. Examiners then compare the fingerprint spectrum from the unknown sample to the reference spectra collected. *Id.* If the sample's

spectrum matches one of the reference spectra, then the material in the sample is identified. *Id.*

McCollam testified that raman spectroscopy is not a new or novel technique, but has been in use since the 1970s. 10/22/13 Tr. at p. 136. He further testified that this technique is generally accepted as reliable in the scientific community and "is widely used in forensic science." *Id.* at p. 137-38. While McCollam was unaware of any known error rates, he did indicate that the technique has been subjected to peer review and publication. *Id.* at p. 138; *see also Impax Labs.*, 2012 WL 1551709, at *8-9 (noting raman spectroscopy has been subjected to extensive and rigorous peer review and has been held to be a scientifically reliable technique). According to McCollam, raman spectroscopy has several non-judicial uses, and is frequently utilized in the pharmaceutical and automotive industries, as well as for academic research. 10/22/13 Tr. at p. 138.

The Court finds that raman spectroscopy is scientifically reliable. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

**j) Scanning Electron Microscopy with Energy Dispersive X-Ray Spectroscopy**

Scanning electron microscopy with energy dispersive x-ray spectroscopy ("SEM-EDS") is a technique used to determine the elemental profiles of an

unknown sample by detecting the types of elements that comprise the sample.[4] 10/22/13 Tr. at p. 81. A scanning electron microscope operates as follows:

> A beam of electrons is scanned over the surface of a specimen, causing secondary electrons to be emitted. The intensity of the secondary electron emission depends on the topography (hills & valleys) of the surface as well as its composition, and hence can be used to build up a point-by-point image of the surface, as the primary beam is scanned over the specimen . . . . [T]he primary electron beam causes x-rays to be emitted by the specimen. The energy of these x-rays is characteristic of the chemical elements that are present in the specimen. This makes it possible to obtain a chemical analysis of the area under observation.

*People v. Palmer*, 145 Cal. Rptr. 466, 471 n.2 (Cal. Ct. App. 1978) (citation omitted).

Scanning electron microscopes have been used by scientists for "many years to identify the chemical composition of substances." *People v. Serrano*, 631 N.Y.S.2d 340, 341 (N.Y. App. Div. 1995) (affirming trial court's order denying a *Frye* hearing on the reliability of SEM). Reynolds testified that SEM-EDS is not a new or novel technique, but has been employed by the FBI for many years. 10/22/13 Tr. at p. 83. She further opined that SEM-EDS is deemed to be generally reliable in the scientific community, and has been subjected to peer review and publication. *Id.* at pp. 87-88. SEM-EDS is also used in other industries, including the pharmaceutical, environmental, and manufacturing industries. *Id.* at p. 88.

[4] Reynolds provided an almost identical description of this process. 10/22/13 Tr. at p. 82. She testified that the abbreviated term for this technique is scanning electron microscopy ("SEM"). *Id.* at pp. 80-81.

The Court finds SEM-EDS is scientifically reliable. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

**k) X-Ray Diffractometry**

X-ray diffraction ("XRD") is a technique used to identify crystalline chemical materials. *Abbott Labs. v. Geneva Pharm., Inc.*, 1998 WL 566884, at *1 n.1 (N.D. Ill. 1998), *judgment aff'd*, 182 F.3d 1315 (Fed. Cir. 1999). XRD works by directing a beam of x-rays toward the sample. *Id.* When the beam strikes the sample, the x-rays are redirected, or "diffracted," at various angles. *Id.* The result is generally depicted as a series of peaks. *Id.* "The position of [a] peak reflects the angle at which the x-rays for that peak were diffracted, and the size of [a] peak is related to the amount of radiation that was scattered at that angle." *Id.* The diffraction pattern makes up the fingerprint of the material, which can then be compared to the fingerprints of known materials to identify the sample. *Id.*

Reynolds testified that XRD is accepted as reliable in the scientific community in general and in the forensic chemistry community in particular. 10/22/13 Tr. at p. 95. It is not a new or novel technique, but has "been around for quite a while." *Id.* XRD is used in a variety of non-judicial capacities, and is a primary technique used in dirt and environmental analysis. *Id.* at p. 99.

The Court finds XRD is scientifically reliable. The defendant has not advanced a specific basis, nor mounted a specific challenge, to allow the Court to conclude otherwise, and the Court is not required to intuit one for him.

### 2. Qualifications of the Prosecution's Experts

In addition to finding that the anticipated expert opinions of the prosecution's explosives experts are grounded in scientifically reliable techniques, the Court also concludes that they are qualified to offer those opinions. The Court discusses each expert in turn.

#### a) Special Agent Garrett Gumbinner

The prosecution has endorsed FBI Special Agent Garrett Gumbinner as an expert witness in the recognition of explosives and the process of rendering them safe. Prosecution's Endorsement of Experts (P-58) at p. 2. The prosecution indicates that it intends to call Agent Gumbinner to testify regarding his observations inside the defendant's apartment, including what he believed to be explosive devices, and the steps he took to render those devices safe. Response at pp. 6-7.

As the prosecution notes, Agent Gumbinner's testimony will not be based on "'scientific' evidence per se;" it will be based on his training and experience as a bomb technician. *Id.* at p. 7. Because Agent Gumbinner's proffered opinions are based in part on his specialized knowledge, skill, education, training, and

experience in explosives, he must be qualified as an expert before he can render those opinions. *See People v. Mollaun*, 194 P.3d 411, 419 (Colo. App. 2008) ("Where an officer's testimony is based not only on his or her perceptions, observations, and experiences, but also on the officer's specialized training or education, the officer must be properly qualified as an expert before offering testimony that amounts to expert testimony") (quotation omitted). A witness may be qualified as an expert "by knowledge, skill, experience, training, or education." CRE 702.

On the record before it, the Court concludes that Agent Gumbinner has sufficient knowledge, skill, education, training, and experience in explosive devices to be qualified as an expert at trial in the recognition of such devices and the process of rendering them safe. Agent Gumbinner has worked as a Special Agent Bomb Technician for the FBI for over eight years. Response Ex. 1. As part of his duties, Agent Gumbinner has responded to investigations and calls regarding improvised explosive devices ("IEDs"), has conducted operational "Render Safe Procedures" in conjunction with local, county, and state bomb squads, and has participated in the collection and maintenance of evidence in support of bombing investigations. *Id.* Additionally, for almost four years, Agent Gumbinner has been the bomb technician coordinator for the FBI's Denver division and is responsible for coordinating 20 accredited bomb squads and over 120 certified bomb

technicians. *Id.* In 2007, Agent Gumbinner and other FBI bomb technicians responded to sites in Iraq were IEDs were the primary weapons. *Id.* Additionally, Agent Gumbinner has extensive professional training in explosive devices. *Id.*

**b) Robert Mothershead II**

Mothershead is a chemist and forensic examiner at the FBI. The prosecution has endorsed him as an expert in the forensic examination of explosives and chemical analysis. Prosecution's Endorsement of Experts (P-58) at p. 3. Mothershead analyzed some of the items recovered from the defendant's apartment and authored a report summarizing his findings. *See generally* Response Ex. 2. On the record before it, the Court concludes that Mothershead is qualified by knowledge, skill, education, training, and experience to testify as an expert in the forensic examination of explosives and chemical analysis.

Mothershead obtained a Bachelor of Arts degree in chemistry from the University of Virginia in 1987. Response Ex. 3. He also has a Master of Arts degree in marine science from the College of William and Mary, with an emphasis in environmental chemistry and toxicology. *Id.* Mothershead has worked as a chemist for the FBI for over seventeen years. During the last eleven years, he has worked as a forensic examiner at the FBI laboratory in Quantico, Virginia. *Id.* He is currently a supervisory chemist and forensic examiner in the FBI's Explosives Unit. *Id.*

As a forensic examiner, Mothershead has performed forensic examinations on evidence submitted to the Explosives Unit in criminal investigations involving fire debris, bulk explosives, and explosive residues. *Id.* He did similar work as a forensic chemist for the FBI's Chemistry Unit on controlled substances, lubricants, ignitable liquids, and general unknowns. *Id.* Mothershead has extensive training in explosives engineering, hazardous materials, forensic infrared spectrometry, forensic chemistry, scanning electron microscopy, mass spectrometry, and gas chromatography. *Id.*

**c) McCollam**

McCollam, a chemist and forensic examiner at the FBI, has been endorsed by the prosecution as an expert in the forensic examination of explosives and chemical analysis. Prosecution's Endorsement of Experts (P-58) at p. 3. Like Mothershead, McCollam analyzed several liquids, items, and materials recovered from the defendant's apartment and subsequently authored a report documenting his findings. *See generally* Response Ex. 4. On the record before it, the Court concludes that McCollam is qualified by knowledge, skill, education, training, and experience to testify as an expert in the forensic examination of explosives and chemical analysis.

McCollam has been employed as a chemist by the FBI for over eighteen years, and has worked for the FBI as a chemist and forensic examiner analyzing

evidence of explosives or explosive-related compounds since 2004. Response Ex. 5. He obtained a Bachelor of Science degree in chemistry from Old Dominion University, and has undergone extensive training in x-ray powder diffraction, scanning electron microscopy, raman spectroscopy, GC/MS, hazardous materials, and the analysis of explosives and explosives residue. *Id.* McCollam has also been qualified in court as an expert in the field of forensic chemistry, and specifically in the forensic analysis and detection of explosives, on seven occasions. 10/22/13 Tr. at p. 121. As a condition of his employment at the FBI, McCollam has completed 15 hours of continuing education every year and passed yearly proficiency tests. *Id.* at p. 123.

**d) Reynolds**

The prosecution has endorsed Reynolds, a chemist and forensic examiner at the FBI, as an expert in forensic chemistry and materials analysis. Prosecution's Endorsement of Experts (P-58) at p. 3. Like the prosecution's other experts, Reynolds intends to testify about her examination of certain items taken from the defendant's apartment. On the record before it, the Court concludes that Reynolds is qualified by knowledge, skill, education, training, and experience to testify as an expert in forensic chemistry and materials analysis.

Reynolds has a Bachelor's degree in forensic chemistry from West Chester University. Prosecution's Ex. 7. She has over fourteen years of experience as a

chemist and forensic examiner for the FBI, during which time she has been responsible for analyzing evidence such as drugs, inks, powders, solids, and liquids. 10/22/13 Tr. at p. 71. Prior to working for the FBI, Reynolds worked as a forensic chemist for the Drug Enforcement Administration Laboratory in New York City. *Id.* She has extensive training in, among other things, GC/MS, FTIR, x-ray power diffraction, raman spectroscopy, infrared spectroscopy, mass spectroscopy, and basic forensic chemistry. Response Ex. 7. As a condition of her employment with the FBI, Reynolds is required to successfully complete yearly proficiency examinations. 10/22/13 Tr. at p. 76-77. Reynolds has been qualified in court as an expert in the field of forensic chemistry approximately 16 times. *Id.* at 74.

**e) Mehltretter**

The prosecution has endorsed Andria Mehltretter, a chemist and forensic examiner at the FBI, as an expert in forensic chemistry and materials analysis. Prosecution's Endorsement of Experts (P-58) at p. 3. The prosecution anticipates calling Mehltretter at trial to testify about her examination of two paintbrushes collected from the defendant's apartment. Response Ex. 8. On the record before it, the Court finds that Mehltretter is qualified by knowledge, skill, education, training, and experience to testify as an expert in forensic chemistry and materials analysis.

For the last ten years, Mehltretter has examined evidence submitted to the FBI's Chemistry Unit, and specifically the paints and polymers subunit. Response Ex. 9; 10/22/13 Tr. at p. 11. She has a master's degree in forensic science from the Florida International University, and a bachelor's degree in chemistry from the University of Florida. Response Ex. 9. Further, like the prosecution's other experts, Mehltretter has extensive professional training related to forensic chemistry and materials analysis, including training in x-ray powder diffraction, pyrolysis, forensic microscopy, and infrared spectroscopy. *Id.* Mehltretter is also certified as a Paints and Polymers Fellow with the American Board of Criminalistics, and is currently the chair of the Tape Subgroup for the Scientific Working Group for Materials Analysis. 10/22/13 Tr. at pp. 14-15. Mehltretter has also been qualified in court as an expert in forensic chemistry and, more specifically, the forensic analysis of paints and polymers, nine times. *Id.* at p. 16.

**f) Jason Abramowitz**

The prosecution has endorsed Jason Abramowitz, an electronics engineer at the FBI, as an expert in the forensic examination of electronics and circuit analysis. Prosecution's Endorsement of Experts (P-58) at p. 3. Abramowitz intends to opine about numerous electronic devices found either inside the defendant's apartment or in the dumpster area outside the apartment, as well as his conclusions regarding the operation of those devices. Response at p. 11. On the record before it, the Court

concludes that Abramowitz is qualified by knowledge, skill, education, training and experience to testify as an expert in the forensic examination of electronics and circuit analysis.

Abromowitz has over ten years of experience working as an electronics engineer for the FBI, during which time he has analyzed electronic devices such as bomb detonation circuitry and unknown electronic circuits. Response Ex. 11. Since joining the FBI in 2003, Abramowitz has supported over 950 electronic device examinations, has testified regarding at least ten examinations, and has undergone extensive professional training. *Id.* Abramowitz also has a bachelor's degree in Electrical Engineering from the Florida Atlantic University. *Id.*

**g) Christopher Rigopoulos**

Lastly, the prosecution has endorsed Christopher Rigopoulos, an explosives and hazardous device examiner in the FBI's Explosives Unit, as an expert in the forensic examination of explosives and hazardous devices. Prosecution's Endorsement of Experts (P-58) at p. 2. Rigopoulos authored an extensive sixty-two page report summarizing the items found in the defendant's apartment and the results of any testing and analysis conducted on those items. *See generally* Response Ex. 12. According to the report, Rigopoulos analyzed the specimens recovered from the defendant's apartment via "photographs, visual inspection, physical measurements, comparisons of observable physical characteristics, and

review of references." *Id.* at p. 61. He concluded that the items recovered from the defendant's apartment constitute the disassembled components of an improvised incendiary explosive device ("IIED"). *Id.* at p. 23.

Like Gumbinner, Rigopoulos did not personally conduct any chemical testing or analysis of any item collected at the defendant's apartment, and his testimony will not be based on scientific evidence per se. However, because his proffered opinions are based in part on his specialized knowledge, skill, education, training, and experience in the forensic examination of explosives and hazardous devices, he must be qualified as an expert before he can render those opinions. *See Mollaun*, 194 P.3d at 419. On the record before it, the Court finds that Rigopoulos is qualified by knowledge, skill, education, training, and experience to testify as an expert in the forensic examination of explosives and hazardous devices.

For the last eight years, Rigopoulos has worked as an explosives and hazardous device examiner for the FBI. Response Ex. 13. In that role, he has been responsible for performing forensic examinations on evidence submitted to the FBI Explosives Unit for purposes of identifying bomb components and reconstructing explosive devices. *Id.* He has also advised FBI Evidence Response Teams regarding the collection and preservation of physical evidence at bombing crime scenes, and has written reports on the results of examinations conducted on explosives and hazardous devices. *Id.* Rigopoulos worked for approximately

seven years for the FBI as a bomb technician, during which time he responded to calls for service regarding IEDs and conducted operational "Render Safe Procedures." *Id.* He has worked internationally with the FBI investigating evidence and crime scenes related to bombings, including a mission to Iraq where IEDs were the primary weapons. *Id.* Additionally, he has extensive training in the areas of explosives, hazardous materials, hazardous devices, and IEDs. *Id.*

**B. Relevance**

Having found that the prosecution's proffered expert testimony is reliable, the Court next analyzes whether it is relevant. The Court concludes that it is.

The defendant is charged with the possession of an explosive or incendiary device. Complaint and Information, Count 141. To prove this charge, the prosecution must establish beyond a reasonable doubt that the defendant knowingly possessed, controlled, manufactured, gave, mailed, sent, or caused to be sent an explosive or incendiary device. § 18-12-109(2), C.R.S. (2013). An explosive or incendiary device is defined under Colorado law as:

> Dynamite and all other forms of high explosives, including, but not limited to, water gel, slurry, military C-4 (plastic explosives), blasting agents to include nitro-carbon-nitrate, and ammonium nitrate and fuel oil mixtures, cast primers and boosters, R.D.X., P.E.T.N., electric and nonelectric blasting caps, exploding cords commonly called detonating cord or det-cord or primacord, picric acid explosives, T.N.T. and T.N.T. mixtures, and nitroglycerin and nitroglycerin mixtures; . . . [a]ny explosive bomb, grenade, missile, or similar device; and . . . [a]ny incendiary bomb or grenade, fire bomb, or similar device, including any device, except kerosene lamps, which

> consists of or includes a breakable container including a flammable liquid or compound and a wick composed of any material which, when ignited, is capable of igniting such flammable liquid or compound and can be carried or thrown by one individual acting alone.

§ 18-12-109(1)(a)(I).

Mothershead, McCollam, Reynolds, and Mehltretter examined different items collected at the defendant's apartment, and their reports indicate that at least some of the items analyzed contained flammable or explosive compounds or residues. For instance, Mothershead states in his report that some of the liquids found in the apartment were gasoline and petroleum distillate. Response Ex. 2. He also determined that one sample was consistent with an ethanol-based gel, which is used in fire starter products. *Id.* Likewise, McCollam identified among the items recovered from the defendant's apartment potassium permanganate and a vial containing glycerine. Response Ex. 4. The prosecution alleges that "[t]he defendant had set up [a] trip-wire at the threshold of his apartment that, if tripped, would have spilled the glycerin into the potassium permanganate mixture." Response at p. 9. McCollam's report notes that when these two compounds are combined, "they spontaneously ignite (a hypergolic reaction) and produce heat, smoke, and solid residue." Response Ex. 4.

Moreover, McCollam tested several of the plastic spheres collected from the defendant's apartment, and determined that some of them contained low explosive

black powder, oil, and smokeless powder. *Id.* He further concluded that the fusing that had been placed around the apartment had a pyrotechnic mixture of potassium perchlorate and carbon, and that two other samples were made up of a low explosive pyrotechnic mixture of iron oxide and aluminum powder, commonly referred to as Thermite. *Id.*

Reynolds and Mehltretter examined two paintbrushes found in the defendant's apartment that were coated with a clear gel material that Mehltretter ultimately determined to be polystyrene, a plastic used in Styrofoam. Response Exs. 6, 8. [redacted] Response at p. 11.

Abramowitz examined numerous electronic devices that were found in the defendant's apartment and in the dumpster area outside the apartment, and intends to testify about how the various devices could be utilized as components of a remote firing system. *Id.*; Response Ex. 10. Gumbinner is expected to testify regarding his observations inside the defendant's apartment and what he believed to be explosive and incendiary devices. Response at pp. 6-7. Similarly, Rigopoulos anticipates opining that several of the items recovered from the defendant's apartment are components of an IIED. Response Ex. 12 at p. 23.

The prosecution's expert testimony, if believed, will assist the jury in deciding whether the defendant possessed, controlled, or manufactured an

explosive or incendiary device, such as "high explosives," an "explosive bomb, grenade, missile, or similar device," or an "incendiary bomb or grenade, fire bomb, or similar device." § 18-12-109(1)(a)(I). Thus, there is clearly a "logical relation," between the experts' anticipated testimony and a factual issue involved in the case. *Ramirez*, 155 P.3d at 379. What's more, the proposed expert testimony is likely to be the most significant evidence related to Count 141. Indeed, it is difficult to imagine how the prosecution could prove Count 141 beyond a reasonable doubt without the proposed expert evidence.

**C. CRE 403**

The Court must consider whether exclusion of the proposed expert testimony is appropriate under CRE 403. The defendant has not asserted, much less demonstrated, that the probative value of the proposed testimony is substantially outweighed by the danger of unfair prejudice, confusion of the issues, misleading the jury, or any of the other considerations identified in Rule 403. The Court has discussed the probative value of the evidence. The fact that the evidence is likely to be detrimental to the defendant does not require the Court to exclude it. *People v. Dist. Court*, 869 P.2d 1281, 1286 (Colo. 1994) ("Proffered evidence should [] not be excluded by the district court as unfairly prejudicial simply because it damages the defendant's case") (citation omitted). Indeed, all evidence offered by the prosecution is likely to be prejudicial to the defendant. The question

for the Court under Rule 403 is whether the evidence "unfairly prejudices [the] defendant." *Id.* (citation omitted).

Based on its review of the record, the Court finds that the probative value of the proffered expert testimony is not substantially outweighed by the danger of undue prejudice. Further, the Court concludes that it is unlikely that the proposed opinions will mislead the jury or risk confusion of the issues. Nor is there any danger of undue delay, waste of time, or needless presentation of evidence. Lastly, the experts' testimony is not likely to be cumulative since each expert played a different role in the examination of the evidence.

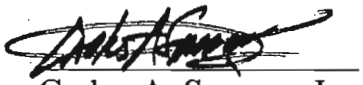
Because the prosecution's explosives expert testimony does not have "an undue tendency to suggest a decision on an improper basis," there is no reason to exclude it. *Ramirez*, 155 P.3d at 379 (citation omitted). Therefore, the Court finds that it is admissible under CRE 403.

**CONCLUSION**

For all the foregoing reasons, Motion D-109 is denied. However, at trial, the prosecution must still qualify their witnesses as experts and provide an adequate evidentiary foundation for their testimony.

Dated this 10th day of March of 2014.

BY THE COURT:



Carlos A. Samour, Jr.
District Court Judge